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BULLETIN NO. 12.—NEW SERIES.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY.

THE SAN JOSE SCALE

IN

1896–1897.

BY

L. O. HOWARD,

ENTOMOLOGIST.

WASHINGTON:

GOVERNMENT PRINTING OFFICE.

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LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
DIVISION OF ENTOMOLOGY,
Washington, D. C., February 20, 1898.

SIR: I have the honor to transmit herewith manuscript of a bulletin which gives an account of the spread of the San Jose scale in the United States during the last two years and of the work which has been done by economic entomologists in the effort to subdue it. I recommend that it be published as Bulletin No. 12, new series, of this division.

Respectfully,

L. O. HOWARD,
Entomologist.

Hon. JAMES WILSON,
Secretary of Agriculture.

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THE SAN JOSE SCALE IN 1896-1897.

INTRODUCTION.

Bulletin No. 3, New Series, of this Division, entitled, "The San Jose Scale: Its Occurrences in the United States, with a full account of Its Life History and the Remedies to be Used Against It," was published in January, 1896, and contains a reasonably full history of the eastern occurrences of this insect down to the close of November, 1895. The demand for this bulletin has been so great that the first edition has been exhausted and a new one has just been printed. Inasmuch as the information contained in the bulletin is authoritative and complete down to the close of the year 1895, it has not been deemed necessary to publish a revised edition. The statements which it contains regarding life history and other important topics have stood the test of two years' scrutiny, and all that seems necessary is the bringing together of additional information which has resulted from two years' work on the part of a majority of the official economic entomologists of the country. Never in the history of economic entomology in the United States has a single species of insect excited so much interest as has the San Jose scale; and in view of the fact that it has aroused the whole fruit-growing population of the country to a sense of the value of entomological investigations, that it has brought about legislation against injurious insects in a number of States, and has almost alone been responsible for an appeal for national legislation, participated in not only by the horticulturists of the country but by dealers in nursery stock, it may be said that its eastern advent has been far from an unmixed evil. Many individuals will have suffered, but the sum total of resulting good to the fruit-growing interests will eventually have placed the balance on the right side. The years 1896 and 1897 have been very active ones on the part of State authorities; so much so that further investigation by the National Department as to spread, exact localities, and many other points has been unnecessary, and it is the purpose of this bulletin simply to bring together under convenient heads the results of the general work of the two seasons.

DISTRIBUTION AND PRESENT CONDITION.

In the light of what we now know, our actual knowledge of the distribution of the San Jose scale in the East in the fall of 1895 was com-

paratively slight. It was than reported as occurring in twenty States, but in comparatively few localities in each, with the single exception of New Jersey. In the latter State, the energetic entomologist, Dr. John B. Smith, had already put in one season's active work, and had discovered that the insect was almost universally distributed in the southern two-thirds of the State. The same condition of affairs was suspected, although not known, in a number of other States. In 1896 and 1897 actual field inspection under Professor Alwood, in Virginia; Professor Johnson, in Maryland; Professor Forbes, in Illinois; Professor Webster, in Ohio; Professor Starnes, in Georgia, and several others, showed that in these States the insect was nearly as widespread as in New Jersey, while twelve States and the District of Columbia have been added to the number containing infested points.

Alabama.—There seems to have been no thorough survey of the State. Three localities have been added by correspondence to those recorded in Bulletin No. 3. There is no mention in that bulletin of the vicinity of Huntsville, but on the authority of a correspondent, and at the last moment before publication, a dot was placed on the map indicating the occurrence of the scale in that vicinity. The entomologist of the State Agricultural Experiment Station at Auburn, Prof. C. F. Baker, however, writes to this office under date of February 16, 1898, that the nurseries about Huntsville are clean and in good shape.

Arkansas.—A single locality in this State—Fayetteville—has just been discovered by Professor Stinson.

Arizona.—There is no information from this Territory beyond that contained in Bulletin No. 3. The insect does not seem to spread rapidly in Arizona and the infested orchards are said not to be numerous.

California.—In this State the insect is or has been generally distributed. The conditions of climate sometimes kill it out, and it often seems to be destroyed by a fungus disease, but, according to Marlatt, neglected and improperly sprayed orchards exhibit trees in as bad condition as can be found in any of the orchards of New Jersey or Maryland. As we have frequently stated, the lime, salt, and sulphur wash is the standard remedy for this scale in California, and is there thoroughly effective, however ineffective it may be in the East.

Connecticut.—This State was not mentioned in Bulletin No. 3, but since its publication the scale has been found in at least five localities which are either along Long Island Sound or in the valley of the Connecticut River.

Delaware.—The active inspection work done by Prof. G. H. Powell and Prof. Wesley Webb has shown that the scale is quite as generally distributed in Delaware as in New Jersey.

District of Columbia.—The scale occurs at several localities in this District. It has been found in gardens in Georgetown, in a public park in Washington, in a small orchard at Eckington, and in two dooryards in Takoma Park.

Florida.—We are advised by correspondents of two localities in this State other than those mentioned in Bulletin No. 3. Judging from the

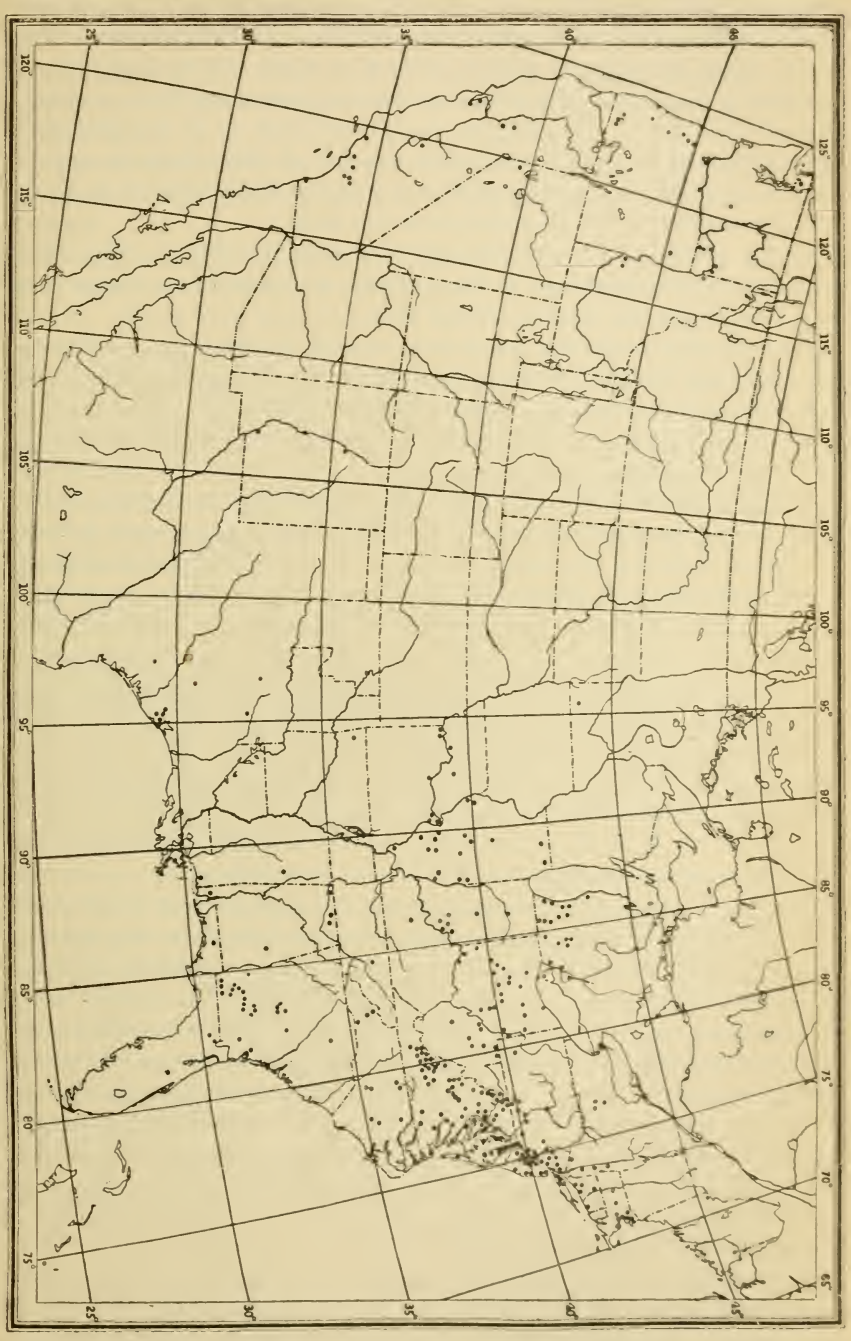

FIG. 1.—Map showing the known distribution of the San Jose Scale at the close of the year 1897. Each black dot represents an infested locality.

reports of Professor Rolfs the scale is not as injurious in this State as it was two years ago. This is attributed largely to the work of the

fungus disease, *Sphærostilbe coccophila*, with which he has been artificially experimenting, and of which he seems to have great hopes.

Georgia.—The four localities mentioned in Bulletin No. 3 have been greatly enlarged by the active inspection work of Professor Starnes, of the State experiment station, who now finds twenty-four infested counties in Georgia, all of which he has mapped being in the southern part of the State. The fungus disease referred to in the preceding paragraph has very recently (late in the fall of 1897) made its appearance in a peach orchard in Jefferson County, southwest of Augusta, and is reported to have exterminated the scale.

Idaho.—Nothing new is to be reported from this State. The insect occurs in several localities in the vicinity of Snake River Valley, and farther north in the vicinity of Lewiston.

Illinois.—The scale was not known to exist in this State in November, 1895, but Professor Forbes, by virtue of special appropriations, has been able to have the State rather carefully inspected, and has found twenty-two colonies in nineteen different localities situated in eleven counties in the State.

Indiana.—Aside from the two localities mentioned in Bulletin 3, Professor Troop, the horticulturist of the Indiana State Experiment Station, has found it during the summer of 1897 in five additional localities in Clark, Jefferson, and Miami counties, many orchards being very badly infested, some having been cut down and burned.

Kentucky.—We learn from Professor Garman that careful inspection of all the nurseries in the State showed, in the summer of 1897, no traces of the scale. Only one locality in the State is known to him, and that is an orchard in Grayson County.

Louisiana.—So far as can be learned, no careful investigation has ever been made of orchards in this State, although, as was pointed out in Bulletin No. 3, stock presumably infested was sold somewhat extensively throughout the State by a dealer in New Orleans.

Maryland.—More actual damage seems to have been done in this State than in almost any other. Professor Johnson has, since his appointment, investigated every county in the State, inspected all the nurseries and many of the orchards. He has located the scale in sixteen out of twenty-three counties, representing forty-three different localities and seventy-four different orchards, in which are growing over a million and a half bearing trees. It may be stated, incidentally, that the writer's main source of information is the receipt of specimens from fruit growers themselves, and that, in spite of the general agitation of the San Jose scale question, specimens have been received at this office from but sixteen localities in the State of Maryland. This illustrates the advantage of inspection by a State official.

Massachusetts.—The writer learns on the authority of Professor Fernald that from his correspondence the San Jose scale occurs in Worcester, Scituate, Roslindale, Bedford, Brookline, Cambridge, Salem, Reading,

South Chelmsford, South Framingham, and Jamaica Plain. It formerly occurred, as we have elsewhere stated, in Amherst.

Michigan.—This State, not known to be infested in 1895, has been found to have a number of infested localities in the southern half. Professor Barrows, in August, 1897, reported fourteen localities in ten counties; evidence showing that the scale has been present in the State since 1890.

Minnesota.—Information concerning a single locality in this State, in the southwestern portion, has been communicated to the writer by Dr. Lugger.

Mississippi.—The occurrence of the scale in this State was assumed, as a matter of course, two years ago, but no definite localities were known. Since that time two such localities have been brought to our attention. Much of the Idaho pear stock sold by Mr. Frotscher, of New Orleans, in 1891 was sent to portions of this State, and there can be no doubt of the establishment of the scale within its boundaries. The almost total silence of Mississippi fruit growers, however, on this subject can not be due entirely to indifference, and we are very much inclined to believe, as will be pointed out later, that in the Gulf States the San Jose scale is by no means as serious a pest as it is in more northern localities.

Missouri.—At the time when Bulletin No. 3 was published there was no certainty of the existence of the scale in this State. The Messrs. Stark Brothers had shown their premises to be uninfested and had proven that the original Japan plum stock which carried the scale from California to New Jersey, although purchased by the New Jersey firms from them, had not infested their home nurseries. Since the appointment of Professor Stedman as entomologist to the State Experiment Station some two years since, he has found sixteen undoubted infested localities in this State.

Nevada.—No localities in this State, beyond gardens in the city of Reno, have been brought to our attention. Professor Hillman, the entomologist of the experiment station at that place, is fortunate in having infested plum trees in his own garden for experiment and study.

New Jersey.—In the fall of 1895 the widespread condition of the scale in New Jersey was already so well known that the writer considered it useless to specify individual localities. Since that time the situation has not preceptibly bettered. In his last bulletin Professor Smith states that all efforts to exterminate the insect in New Jersey must be abandoned. It is well established in the line of towns along the Delaware River from Burlington to Camden, in gardens as well as orchards, and hedges and small fruits as well as tree fruits being infested. It is on Jersey City Heights, and city and suburban gardens and yards are infested. Several of the infested orchards are close to or adjoin wood or scrub land, with blackberry and other vines along the fence lines and in the open spaces, and into these the insect has spread. There is little

or no scale in the State north of a line running obliquely from Trenton, on the Delaware, to a point north of Perth Amboy, excepting only Jersey City and a spur running north to Hackensack. South of this line there are a number of infested centers.

New Mexico.—Information concerning five infested localities in this Territory has been transmitted to us by Professor Cockerell.

New York.—As reported in the previous bulletin, there are several infested localities on Long Island, including at least two nurseries. The localities of New Milford and Kinderhook were also there reported. Since 1895 Professor Slingerland has found the insect at Ithaca and Farmer, on Cayuga Lake, and it has also been found in two additional localities in the Hudson River Valley. Its occurrence at Union Springs is also reported by Mr. Lowe.

North Carolina.—This State is new to our records. Through the efforts of the late entomologist of the experiment station, Mr. Gerald McCarthy, and Prof. W. F. Massey, the horticulturist, the scale has been found near Tarboro, Faison, Greensboro, Goldsboro, Asheville, Gibsonville, and Southern Pines. The last-named locality was also ascertained by this office by independent correspondence. Other localities will doubtless soon be found.

Ohio.—The excellent work which Professor Webster has done in this State during the past two years has resulted in the mapping of fifteen localities of infestation in addition to those recorded in Bulletin No. 3. One of the most serious outbreaks in the State occurs upon Catawba Island, situated in Lake Erie, north of Sandusky.

Oregon.—No additional localities have been received from this State, but it is noticed from the newspapers that the State officials have, within the past few months, become somewhat more interested in the subject than during former years, and that the statement is made that the insect is spreading to some extent into new orchards.

A recent letter from Professor Cordley indicates that the scale is very generally distributed in southern Oregon throughout most of the Rogue River country. It is also present in the Umpqua River Valley and at a number of points in the Willamette Valley. He states, however, that it does not seem to spread so rapidly, nor is it so destructive as in those portions of the State in which the cold spring rains are less abundant. It is reported as being present in the Hood River Valley and is very destructive about The Dalles, through the Walla Walla Valley, and at Union, in the eastern part of the State.

Pennsylvania.—At the time of publication of Bulletin No. 3 five localities were known in this State. Since that time we have learned by correspondence of eight new localities, all of which are in the southeastern portion of the State, with the exception of one, which is in the southwestern portion, south of Pittsburg. Other localities may have been ascertained in the course of the State inspection which has been carried on largely by Dr. Groff, but if so they have not been published or communicated to this office.

South Carolina.—This State is new to our records. Largely owing to the fact that South Carolina has only recently appointed an entomologist, little work has been done in the State. Specimens have reached here, however, from Newberry, and I think other localities will doubtless soon be ascertained. This is at present the only one known in South Carolina.

Tennessee.—This is a State new in our records, and, so far as known to us, the scale has been found at but one locality in the eastern portion of the State, just west of the Appalachian system.

Texas.—This State is also new to our records, and we have learned by correspondence of eight localities, four of which are in Galveston County, one near Dallas, one near Tyler, one in the Brazos bottom south of Calvert, and one near the Guadalupe River east of San Antonio.

Virginia.—But two localities from this State are recorded in Bulletin No. 3. During 1896 and 1897, under the operation of a State law, Professor Alwood covered the State more or less thoroughly, and has learned many new localities. He reports twenty-seven counties and about one hundred individual premises in the State now known to be infested. In the meantime, by correspondence, fourteen new localities have come to us. It seems certain that the State is pretty well dotted over with the scale.

Washington.—Fruit growers in Washington have recently become somewhat alarmed by the spread of the scale in that State. It has been known for a number of years near Walla Walla and Tacoma, and the recent widespread interest in the subject has brought to light a number of other occurrences, mainly in the Walla Walla, Snake River, and Yakima valleys, and considerable State work is now being carried on.

West Virginia.—Several new localities in this State have been reported by Prof. A. D. Hopkins, viz, Martinsburg, Morgantown, Charleston, Trebada, Buckhannon, McKim, Meadville, and Syracuse.

Canada.—In Bulletin No. 3 the occurrence of the insect in British Columbia was noted. During 1897 it has been found in lower Ontario in two or three localities in the region bordering Lake Erie on the north. The government in Ontario has become interested and has adopted regulations, while the Dominion Government is at present considering legislation.

CLOSELY ALLIED SCALES.

In May, 1897, there was published from this office a technical bulletin, entitled, "The San Jose Scale and Its Nearest Allies," by T. D. A. Cockerell, the principal object of which was to enable entomologists to distinguish readily between the eight or nine closely allied species of the genus Aspidiotus, which are rather difficult to distinguish. There seems, however, still to be some difficulty among certain workers in readily distinguishing the San Jose scale (*Aspidiotus perniciosus*) from the Putnam scale (*A. ancylus*) and the Forbes scale (*A. forbesi*), and

many specimens are sent to the Division of Entomology almost every week of the two last-named species under the supposition that they are or may be *A. perniciosus*. As a matter of fact, with a little experience, *A. perniciosus* can be distinguished from either of the other species by the scale alone with a hand lens. *A. ancylus* and *A. forbesi*, however, can not readily be distinguished from each other without a microscopic examination of the anal plate of the adult female, although the old female scales of *ancylus* are rather larger and flatter than those of *forbesi* and the exuvia are less conspicuous. Moreover, in winter the only mature or nearly mature specimens of *forbesi* to be found are dead, while nearly mature specimens of *ancylus* normally overwinter. Professor Johnson has called the writer's attention to this important point. There is given below a little analytical key which it is hoped will be of service in separating these three species. It is based upon characters used by Mr. Pergande, the assistant in charge of the insectary, in his daily work of determining these forms:

Young female scales.

Dark gray, or, if rubbed, black; toward center more or less distinctly black with a more or less distinct central white dot and surrounding ring.....*perniciosus.*

Purplish or pale grayish, the margin of the darker scales grayish; exuvia orange, covered with a delicate pale grayish exudation with a whitish central dot and surrounding ring.....*ancylus* and *forbesi.*

Male scales.

Yellowish gray or greenish gray; excretion covering the exuvia either concolorous or dark gray and with a more or less distinct white dot.....*perniciosus.*

Purplish, with the margin grayish; exuvia orange and covered with a delicate layer of pale grayish excretion and a whitish central dot.....*ancylus* and *forbesi.*

Old female scales.

Scale yellowish gray, exuvia yellow. Anal plate, with four terminal lobes; groups of pores absent.....*perniciosus.*

Scale pale yellowish gray, exuvia orange.

Anal plate, with two terminal lobes and five groups of pores, the anterior group consisting usually of three, the anterior lateral groups of about twelve, and the posterior groups of about eight pores.....*ancylus.*

Anal plate, with four terminal lobes and four groups of pores, each group composed of from four to six pores (rarely there is a fifth group of one or two pores).....*forbesi.*

FOOD PLANTS.

It was said in Bulletin No. 3 that practically all deciduous fruit trees and various small fruits as well as many shade trees and ornamental shrubs are affected by this insect. A list of food plants was given, comprising, in general terms, twenty-eight species. Since then about seventeen have been added to the list. A revised list follows.

Under such headings as pear, apple, quince, etc., many varieties could be named, but this would unnecessarily extend the list.

Orchard fruits.
- Pear.
- Peach.
- Apple.
- Plum.
- Cherry.
- Rocky Mountain Dwarf Cherry.
- Persimmon.
- Quince.
- Flowering Quince.

Small fruit.
- Strawberry.

Bush fruits.
- Raspberry.
- Gooseberry.
- Grape.
- Currant.
- Flowering Currant.
- Black Currant.

Nut plants.
- Almond.
- Chestnut.
- Pecan.
- Black Walnut.
- English Walnut.
- Japan Walnut.

Miscellaneous ornamental plants, forest and shade trees.
- Rose.
- Hawthorn.
- Spirea.
- Cotoneaster.
- Euonymus.
- English Huckleberry.
- Linden.
- Acacia.
- Elm.
- Osage Orange.
- Alder.
- Sumac.
- Weeping Willow.
- English Willow.
- Golden Willow.
- Laurel-leaved Willow.
- Milkweed.
- Catalpa speciosa.
- Lombardy Poplar.
- Carolina Poplar.
- Golden-leaved Poplar.
- Silver Maple.
- Cut-leaved Birch.
- Mountain Ash.
- Japanese Quince.
- Actinidia.
- Citrus trifoliata.
- Red Dogwood.
- Snowball.
- Juneberry.
- Loquat.
- Laurel.
- Akebia.

RELATION OF CLIMATE TO SPREAD.

Although the San Jose scale has been found at several points within regions which have been mapped as belonging to the so-called transition life zone, no facts have developed which would upset the main conclusions arrived at as to the probable limitations of spread of this insect in injurious numbers. The present known localities of establishment are comprised, with but few exceptions, within the regions known as lower and upper austral, and the few exceptions, the writer is inclined to believe, will be found to come under one of two categories: Either these points contain so strong an admixture of upper-austral forms as to justify the redrawing of the dividing line between upper austral and transition, or the scale will not prove even approximately as injurious as in thoroughly accepted austral regions.

The exceptions indicated are mainly those in the vicinity of Boston, Mass., those in the vicinity of Cayuga Lake, New York, and the more

northern of those in Michigan, as well as one at Amherst, Mass. The coastal law which brings about the intermingling of northern and southern forms will probably justify the eastern Massachusetts occurrences. The river-valley law will justify the occurrence at Amherst, and, in fact, sufficient stress has not been placed upon the occurrence of many southern forms well up the valley of the Connecticut River. It is admitted by Dr. Merriam that his old line across the southern portion of the lower peninsula of Michigan may not be accurately drawn, and, in fact, he believes that it should extend up the coast of Lake Michigan at least sufficiently high to include Little Point Sable. The occurrences near Cayuga Lake are so close to the northwestern loop of the upper austral in New York as to have been practically expected. The valley of the lake lies low, with high hills on the side, and its outlet is in a rather low-lying region. It is still, therefore, in the writer's opinion, safe to say that the insect will not prove dangerous in true transition regions.

An interesting case was brought to the writer's attention a year ago by Mr. C. Hinze, of Payette, Idaho, who sent apple twigs which, according to his statement, in November were fairly covered with the scale, and which after a cold snap, with a temperature of 8° below zero, were examined with the result that most of the scales were found to have dropped off, while those which were left were many of them dried up. Examination at this office showed a few specimens still living.

It begins now to be evident—and we did not suspect it before—that the insect may not prove as injurious in lower austral regions as in upper-austral territory, and it may be that this is due to the parasitic fungus *Sphærostilbe coccophila* in these more southern States. Certain facts seem to point plainly to this condition. The scale certainly did no great damage in the vicinity of New Orleans, where it existed for certainly four and probably five years. As we have already pointed out, nothing has been heard from many cases of diseased stock sent out to various points in the Gulf States from New Orleans in 1891. Professor Rolfs finds that the fungus disease is doing good work in Florida, and on two occasions we have received reports from portions of Georgia to the effect that scales upon badly infested trees were nearly all dead.

NATURAL ENEMIES.

In no case since the publication of Bulletin No. 3 have any of the insect enemies of the scale been reported to have done any especial good. *Aspidiotiphagus citrinus* has been reared from scales from the South, and *Aphelinus fuscipennis* from scales from the North, while the little ladybird, *Pentilia misella*, has been found in a number of localities.

Attracted by the California reports of the efficacy of certain of the Coccinellids imported by Mr. Koebele from Australia, the New Jersey State Horticultural Society early in 1896 memorialized the State legislature and asked for an appropriation of $1,000 for the purpose of im-

porting into the State of New Jersey natural enemies and parasites from other States and countries. The appropriation was made, and in the spring of 1896 Dr. Smith, the entomologist, visited parts of California and secured the sending of several species of Australian ladybirds to various places in New Jersey and to Washington. In his report for 1897, received February 16, 1898, Dr. Smith says:

> Nothing has been seen in 1897 of the California Coccinellids introduced in 1896. Most of the places in New Jersey in which they were introduced were searched by myself on several occasions, but not a sign of the species has been noticed.

No result has been obtained from the specimens sent to Washington, no living specimens having been seen during 1897.

An interesting and important development of the past two seasons' work, however, has been the identification and study of the parasitic fungus *Sphærostilbe coccophila*. Professor Rolfs, of the Florida station, has devoted a bulletin largely to the consideration of this fungus, which, as previously stated, seems to be prevalent throughout the Southern States. He has shown experimentally that the fungus may be transferred to trees affected with San Jose scale and the disease produced among the scales. His process was to inoculate acid bread with pure cultures of the fungus, and three weeks later the application was made in the following way: A piece of the bread about an inch square was placed in cold water and shaken until the bread was broken up and the spores distributed in the water. This water was then applied to the scaly tree by means of a sponge or cloth, or sprayed on. The applications were made in midsummer of 1896 and observations were made as to the results late in February, 1897. Four of his experiments resulted successfully and three unsuccessfully, while in the eighth experiment the result was doubtful on account of the tree having died between the times of treatment and inspection. Professor Rolfs has distributed cultures to entomologists in the North and West, but no very satisfactory field results have as yet been obtained, except perhaps by Professor Smith, who shows in his annual report for 1897 that while attempts to transmit the disease, both by tying infested twigs received from Florida upon badly infested trees in New Jersey and by washing and spraying with diluted cultures of the fungus, were nearly all barren of result, one series of experiments was somewhat encouraging. Twigs from Florida containing San Jose scales infested by the fungus were sent to Mr. Horace Roberts, at Fellowship, N. J., about the middle of June. On September 25 Dr. Smith found the fungus upon almost if not quite all of the trees on which twigs had been tied.

> It had usually spread pretty well over the tree and in some cases was obvious from the surface of the ground to the extremities of the branches, hundreds of patches of the orange fruiting processes being everywhere noticeable. I did not find any case where the disease had spread from the tree on which it was originally introduced, but it may have been present in another less visible stage. By no means all the scales on the trees containing the disease were dead.

A number of instances have come to our observation of the death of the scale in a wholesale manner from the spontaneous work of this disease, or from some other cause. For example, Mr. G. R. Pilate, of Tifton, Ga., sent us scale-infested cuttings in January, 1897, from an orchard which, in his opinion, had been freed from scales by this fungus disease. Careful examination showed that upon one cutting, out of 183 scales, but 4 were living; on a second cutting, out of 723, but 2 were living; on a third cutting, out of 579, but 28 were living, giving 34 living scales out of 1,485—a mortality rate of 97.7. We have recently learned through Professor Starnes, of the Georgia Experiment Station, of a similar instance in the vicinity of Wadley, Ga. Professor Alwood has noted at Vienna, Va., the death of a considerable proportion of the scales presumably from the same cause, and Dr. Fletcher has found fungus-infested scales at Fruitland, Ontario, although the fungus is probably a different one.

REMEDIES.

The matter of remedies has received a severe test since the publication of our last article. The whale-oil soap treatment, which was recommended as the best then known next to the radical process of cutting down trees and burning them, has, when properly applied and when potash soaps are used, fulfilled our expectations; but the insect develops and multiplies so rapidly that even after a reasonably thorough and satisfactory winter treatment with whale-oil soap, it has been found that the insect is once more very abundant by the close of the following summer. The escape of 5 per cent of the insects, or even less, after winter treatment will result in the speedy restocking of the trees. It is no wonder, then, that experimental work has been carried on with other substances.

GAS TREATMENT.

Hydrocyanic-acid gas has been used extensively for nursery stock with good results by some and with poor results by others. Professor Alwood has experimented with it upon nursery stock very thoroughly, and in his bulletin No. 66 was the first to describe a fumigation house. He considers that the work has been successful. Stock fumigated by nurserymen, however, has been examined at this office with the result that in some cases not more than 70 per cent of the scales were killed. Professor Johnson has also superintended the gas treatment for nursery stock carried on by probably the largest firm of nurserymen in Maryland. He tells the writer that this firm has constructed a small building divided into two rather large rooms, each with a capacity of 10,000 first-class nursery trees. While the fumigation is going on in one room the other room is being aired and the stock removed. Professor Johnson estimates the expense not to exceed 2 cents per 1,000 trees for actual cost of chemicals. There are also two small rooms for fumigating smaller lots of stock. The necessity for thorough airing of the rooms before the stock is removed was well shown in the experience of this

firm. A negro laborer entered the room too soon, contrary to orders, and began pulling on the end of the bunch of nursery stock. He suddenly fell forward on his face unconscious and was carried out into the open air and laid on his back, reviving in about five minutes. Had this negro been alone at the time it is quite possible that the incident would have resulted fatally. For fumigating on a small scale Mr. M. B. Waite, who is connected with the Division of Vegetable Physiology and Pathology, United States Department of Agriculture, and who owns a country place and grows fruit, has constructed a fumigating box 4 feet deep, 8 feet long, and 3½ feet wide, in which, before planting them, he fumigates all nursery trees purchased. The box is made from rough boards lined on the inside with painted cloth. It has a top lid with hinges. The largest series of experiments with this gas upon growing trees has been carried on by Professor Johnson at Chestertown, Md. These tests were made during the six weeks beginning October 15, 1897, and carried on under all possible conditions. The results can not be ascertained until another season, but this work should settle the question as to the availability of hydrocyanic-acid gas in the orchard.

PURE KEROSENE.

The most interesting development of the past year in remedial work has been the use of pure kerosene as a spray. The results of meager experiments which were made in the winter of 1894–95 with pure kerosene and with kerosene emulsion, by Messrs. Marlatt and Coquillett, of this division, did not encourage further experiment along this line. Experiment No. 42, of the series conducted during that winter, was made with pure kerosene which was applied in the form of a spray on January 23, 1895, to two trees, one badly infested with scales and the other a vigorous tree less infested. On March 11 careful examination showed that all the scales were dead, but upon May 4 both trees were found to be dead. Experiment No. 23 of the same series was with undiluted kerosene emulsion. It was made December 16. On May 4 all scales were dead, except in isolated spots where the wash apparently did not reach, but the tree was dead or dying, except one limb which was in leaf and fruit. Experiment No. 38, which was conducted with the undiluted emulsion on January 23, was found to result on March 11 in the death of the scales, but upon May 4 the tree was found to be dead, with the exception of one or two branches which were making a feeble effort to leaf out. Experiments made with the kerosene emulsion, diluted with an equal amount of water, apparently did not injure the trees, except where these were already in a moribund condition from borers or enormous numbers of scales. These applications were all made to peach trees. With these results in view experimental work was diverted entirely to other substances.

In August, 1896, Mr. F. M. Webster reported to the Buffalo meeting of the Association of Economic Entomologists that in two orchards near

New Richmond, Ohio, kerosene in an undiluted form had been used with marked success both in 1895 and in 1896, "without the least injury to the trees, either apple or peach. * * * Where the top was seriously infested with scale this was cut away and burned, the trunk painted with kerosene, and at the proper season grafts were placed in the stubs of the old limbs that had been left sufficiently long for the purpose. In this case a new top has been grown on the old trunk, often a more symmetrical top than the original, the tree thereby losing but little by reason of the attack by the scale. Last July I went through the orchard and found many of the trees thus treated growing nicely and free from scale. * * * Where trees were known to be slightly infested, or as a means of killing the scale on any trees not known to be infested, an entire orchard, consisting of both apple trees and peach trees, was sprayed with undiluted kerosene during February, and in order to make sure that no scale escaped alive a second application was made shortly after. I saw the orchard in April and again in July, and in neither case did I notice any injury whatever to the trees, either apple or peach."

This statement by Mr. Webster occasioned much comment among the entomologists in attendance at the meeting, and several of them soon after began experimental work. The result of the experiments carried on in this Division were summarized by Mr. Marlatt in a paper presented to the Association of Economic Entomologists at its Detroit meeting in August, 1897, and are here quoted:

The discussion of this substance at the last meeting of the association led to some additional experiments on our part with the use of pure coal oil or kerosene on plants. Various trees, including young and vigorous peach, pear, cherry, and apple trees, euonymus bushes, and some old bearing peach trees, were thoroughly sprayed with pure kerosene early the past spring, with one exception, before the buds had begun to swell. In the case of two large bearing peach trees the blossom buds were swelling and opening, and these trees were also badly infested with *Diaspis lanatus*. The other plants, with the exception of the euonymus bushes, were healthy and free from all insects. Much to my surprise and astonishment, no ill effects of any moment resulted in the case of any of the trees sprayed with kerosene. In the case of all the trees spraying was continued just long enough to moisten the plants thoroughly, but not to cause the oil to run down the trunks and collect about the base; and with the young trees the soil was carefully mounded up and pressed about the crown to avoid all danger of the oil collecting at that point.

The pear trees treated, and also the peach, came out in full bloom, the opening of the blossom buds not being at all interfered with by the oil bath. After the bloom fell the peach trees treated with pure oil made much finer growth than untreated trees. This may have been in part due to the more favorable location of the trees, and possibly also to the fact that in the treatment with the coal oil the eggs of Aphides on the trees had been entirely killed, whereas on the untreated trees a very bad infestation with plant lice developed early and checked the growth of the trees, killing some of them. No Aphides, however, appeared on the sprayed trees. In the case of the pear trees particularly, and also the apple, the unfolding of the leaf buds was very noticeably delayed as compared with untreated plants, the buds seeming to open up much more slowly, and for two weeks at least the difference was very marked. Very soon thereafter, however, the treated trees overtopped the

others both in abundance of foliage and amount of new growth, and at the present writing (July 20) there seems to have been no injury whatever as a result of the treatment.

The large peach tree sprayed showed no ill effects, and all of the scales on the tree were killed except where they had been protected in a few instances by masses of leaves webbed about the limbs. At least 99 per cent of the scales were killed. On the euonymus a similar result was shown, at least 99 per cent of scales having also been killed by the oil.

These results are so greatly in contrast with those previously attained in the experiments conducted in practically the same way that it seems difficult to account for them. That spraying with pure oil will often kill trees can not be doubted, even when applied in the dormant condition in winter, as demonstrated by experiments on a number of apple and peach trees two or three seasons ago. It is possible that with these earlier experiments the same care was not employed to prevent the collection of oil about the trunks of the trees, and the trees were not mounded up, but the work was as carefully done as would ordinarily be the case in actual practice, and probably much more so. It is possible, therefore, that the death of the trees in some instances was due to the collection of the oil in the cavity formed about the trunk by the swaying of trees in the wind, which, as will be shown later, has had disastrous results in California with the emulsion even. Others have reported the use of oil on trees without injurious effects in some instances, and in others with injurious effects, so that pure oil as an insecticide is one to be used with caution and with full appreciation of the fact that the death of the plant may result.

An earlier result came to the Division by correspondence, when in the first week in March, 1897, the Messrs. Parry, of Parry, N. J., sent in cuttings of dwarf pears which it was said had been sprayed with pure kerosene oil and which had a distinct kerosene odor upon receipt. Examination, probably about a week after the spraying operation, showed that of 100 scales selected at haphazard from the twigs, 51 were dead and 49 were still living. This was not encouraging, but no details were given by Messrs. Parry as to the method of spraying.

September 1, 1897, Prof. J. B. Smith issued a circular headed "Treatment for the San Jose Scale," in which it was stated that although his 1897 experiments with insecticides against the San Jose scale were not yet completed, the results obtained up to that date indicated the desirability of a change in the treatment heretofore recommended. He indicated that instead of winter applications summer work would prove most satisfactory and undiluted kerosene the most effective insecticide. The following sentence was published in large type: "Spray thoroughly in September all infested bearing apple, pear, plum, and peach trees with undiluted kerosene, during the middle of a clear, sunshiny day." Treating nursery stock and very young trees with undiluted kerosene was not recommended. The statement was made that the scales will continue active throughout September, and that kerosene had proved uniformly fatal to all stages in all experiments made up to that time. No injury had been caused on any treated trees except on plum after a spraying made in early spring, and this injury was temporary. The ordinary burning fluid used in lamps was the substance recommended, and it was said that it should be applied "in

the finest possible spray," and "every part of the plant should be thoroughly wet but no more. One application should be sufficient, and it may be delayed, if necessary, until the fruit has been removed." This circular was copied in a number of agricultural newspapers.

In the meantime Professor Alwood had experimented (see Bull. 72, Va. Agr. Exp. Sta., issued January, 1898) in March, 1897, at Occoquon, Va., and we quote the following account from his bulletin:

Here in an orchard of about six thousand trees, mostly pear, six to eight years old, but including Japanese plums and some old peach trees, I found about three hundred pear trees, one hundred plum trees, and a number of old peach trees infested. The latter were condemned as worthless, and the other infested trees in the midst of such an orchard furnished a grave matter for consideration as to what should be done. The owner was willing to use any treatment I might suggest to avoid cutting down the trees; consequently it was agreed that pure kerosene should be sprayed over these trees at once. The work was begun March 11, after the buds were perceptibly swollen. One hundred Abundance plum, sixty Kieffer and two hundred and fifty Bartlett pear trees were sprayed. On about twenty-five of the plum and pear trees the treatment was repeated on the 23d of March. None of these trees were destroyed, and all the pears and most of the plums made a vigorous growth. A few plum trees appeared slightly weak this fall, but I could not determine that this was from the effects of the treatment. The trees treated with kerosene appeared to be entirely free from the pest when examined September 11. This result is not surprising so far as killing the insects is concerned, because it is well-known that kerosene is fatal to such insects, but the generally vigorous appearance of the trees was a surprise, as I had feared that many would be killed.

After examining the above trees I had a number of young pear and apple trees treated elsewhere. This was late in September. They were crusted with the scale insects, yet all were apparently destroyed in a few hours, and, so far as could be told, no serious damage was done to the trees. On pears it caused the shedding of the leaves in about three days, but the plants were practically matured and I think will not be harmed. I have also had kerosene used on old trees, peach and apple, but it is too soon to speak of results.

Further in the same bulletin, under the head of "Winter treatment for young orchards," he says:

I now believe that pure kerosene can be safely used on all the hardy fruit trees, but for fear of serious results am not willing to recommend it in the hands of untrained persons when the soap wash promises good results.

Under the head of "Treatment for old orchards" he recommends kerosene, except for peach and cherry, with the proviso that great care should be used to only moisten the bark, and not to put on enough oil to run down the stem and collect about the base, and to spray only on a warm bright day when the plants are perfectly dry. He further says that low grades of kerosene are more dangerous to the plants than high grades.

Professor Webster had also been experimenting during 1897, and his experiments appear to have been very carefully made. (See Bull. 81, Ohio Agr. Exp. Sta., July, 1897.) His conclusions are as follows:

Judging from all the information we have gained, it seems that kerosene (coal oil) can not be safely used on peach trees or on plum trees of tender varieties, but that

if applied lightly with a brush to the more hardy plums, pears, and apples, especially the latter, it can be used safely, especially if the trees are cut back to trunks and bases of limbs. In the case of the apple I feel quite encouraged, believing that if used sparingly and evenly during winter and while a low temperature prevails it will save many trees that otherwise would have to be destroyed.

After the publication of his September, 1897, circular, Professor Smith prepared a bulletin entitled "The San Jose Scale and How It May Be Controlled," which bears date of November 27, 1897, but which was not distributed until late in January, 1898. The two following paragraphs from this bulletin summarize his present views:

Apple, pear, quince, plum, cherry, peach, and a large variety of other trees were sprayed in August, and even the nursery trees came through the ordeal in safety in almost every instance, while in no case was any large tree killed or even seriously wounded. In one instance bearing Kieffer trees were sprayed in July and September and given heavy doses, with the result of killing only a few water sprouts.

The essential points to be regarded in the application of kerosene are the finest possible spray, the completest and thinnest possible coating over the entire surface, and weather conditions favoring rapid evaporation. The trees themselves should be dry. Any departure from these suggestions may cause injury, for I wish it distinctly understood that kerosene improperly used is fatal to plant life.

Elsewhere he emphasizes the desirability of a more perfect atomizer than is now on the market, since the kerosene should be applied in the form of an almost impalpable mist. All trimming should be done, according to Dr. Smith, at least a month before kerosene is applied. A clear dry day should be selected, so that the kerosene may evaporate rapidly. The trees themselves should be perfectly dry. If he were confined to one application only, he would select September treatment with kerosene as most likely to be completely effective.

Mr. H. N. Starnes, of the Georgia Experiment Station, in an excellent bulletin published in October, 1897, quotes Dr. Smith and Professor Webster and announces the fact that he has arranged a series of tests in different parts of the State, but gives no results. His remedial recommendations for Georgia districts are condensed in the following: "Two applications of whale-oil soap (2 to 2½ pounds to the gallon, warm) a month apart in the fall—say the middle of November and December, respectively—followed by several kerosene sprayings (1 part to 15) at intervals of two weeks in the spring." The kerosene sprayings recommended are made by means of the mechanical mixture of kerosene and water with the "Weed kerosene tank."

In North Carolina pure kerosene has been used to some extent. Prof. W. F. Massey, of the State Agricultural Experiment Station at Raleigh, informed the writer under date of January 10, 1898, that spraying with pure kerosene has destroyed the San Jose scale in more than one locality and no harm has been done to the trees. At Fayetteville, in a nursery where there were two or three affected trees in the winter of 1896–97, the owner is said to have sprayed the whole collection with kerosene when in leaf in May and did not kill a tree.

From this rather full testimony (and more might be adduced from

recent bulletins and correspondence) it becomes at once evident that too little weight has been given to the possibility of the use of pure kerosene upon living plants—its insecticide qualities not having been doubted—and that the experiments of Professor Webster's correspondent in 1895–96 bid fair to lead us to important results. It is true, as was pointed out in Bulletin No. 3, that Matthew Cooke as early as 1882 reported the successful use of coal oil for the San Jose scale, although in the same year (Ann. Rept. U. S. Dept. Agric., 1881–82, p. 208) he shows that in one orchard all peach trees were killed by its use and that many young apple orchards had been destroyed. Also in his well-known book on "Injurious Insects of the Orchard, Vineyard," etc., he publishes the caution, under the head of "San Jose scale," "Beware of mineral oils."

To Dr. Smith, however, must be given the credit of showing the best way to apply the oil—the only safe way, if there be a safe way. His latest publication (Bull. 125, N. J. Agr. Exp. Sta.) shows how guarded we must be in applying kerosene, and from one point of view it is a pity that his original circular of September, 1897, did not emphasize to a greater degree these safeguards, since it undoubtedly encouraged work by which hundreds of trees have been destroyed. As an instance, we may mention the case of a North Carolina correspondent, who, having seen the newspaper publications of the kerosene method in September, 1897, and having found the San Jose scale scattered more or less over an entire orchard of 400 acres of peach trees, sprayed with kerosene pretty thoroughly all portions of the infested trees. The result was that on January 10, 1898, he reported to this office that at least 90 per cent of the sprayed trees were dead. The correspondent was much discouraged by this result and was inclined to think that the only remedy is to dig and burn the trees. It is from such experiences as this that we have decided not to recommend the pure-kerosene spray as the result of anyone's experience without first advising the individual fruit grower to experiment in a small way and determine for himself by experience in his own locality and under the local conditions which exist there whether he can use kerosene to advantage. This warning will not be necessary, perhaps, in the case of men of reasonable caution, but it is evident that there will be many who will need it. Mr. J. H. Hale, as an example of the former class, informed the writer in conversation on February 9, 1898, that in spite of what had been written he intended to conduct careful experiments on a small scale, both at his Georgia and Connecticut places, wisely deeming that the details of a process which might be successful in portions of New Jersey might not be identical with the details in Georgia, and that here again, with conditions varying from those in Connecticut, identical results might not ensue in the latter State. In other words, if the writer were a fruit grower he would experiment for himself with the kerosene and upon his own individual results he would base his conclusions.

AUTOMATIC MIXTURE OF KEROSENE AND WATER.

Previously published objections by this Division to the use of apparatus for automatically mixing kerosene and water have been based on the fact that careful trials of the early constructed machines showed that the oil and water could not be sprayed with uniform regularity as to percentages of the ingredients. Late improvements, however, have largely done away with this difficulty, and there are now machines on the market which accomplish the desired result with reasonable efficiency. These machines are coming into some use, and Mr. Gould, of the Cornell Station, does not hesitate to recommend an automatic mixture of 1 part kerosene to 4 parts water, which he has determined will not injure foliage of Cornus and Pyrus in June and July at Ithaca, N. Y. In the same way Professor Starnes, of Georgia, advocates the use of the automatic mixture 1 part kerosene to 15 parts water.

EFFECT OF WINTER WASHES UPON BLOSSOMING.

The experience of the past two years has shown that most strong winter applications of insecticides, especially of whale-oil soap and resin wash, may have a more or less serious effect upon the blossoming of the tree. Reports to this effect first began to reach us from fruit growers in the vicinity of De Funiak Springs, Fla., one of the earliest localities where the scale was found in the east, and a little later our own experience in Charles County, Md., verified this result. The experience of Captain Emory, in Kent County, Md., showed that spraying in the fall with strong whale-oil soap solution invariably reduced the number of blossoms to a very light percentage. Captain Emory informs the writer, however, that in spite of this destruction of the great majority of the blossoms his trees bore nearly as full a crop as he would desire. He was convinced, however, that late fall spraying generally produced this result. The experiences of others coincide. Spring spraying, however, does not produce such an effect upon the fruit buds. When they have once begun to swell the action of the insecticide does not seem to be strong enough to seriously affect them. Thus Dr. Smith, in his last report, advises that winter treatment should not be made until February and may be delayed until March. This advice we are quite inclined to indorse. Sprayings have been made when the tree was actually in blossom without injurious effect upon the crop.

PREPARING THE TREES FOR TREATMENT.

The important point should be borne in mind that in the majority of cases the trees must be prepared for insecticide treatment. Trees badly infested should always be severely pruned. This process renders the insecticide application always much more efficient. It is true, however, that pruning the trees to a certain extent, and thus reducing the density of the foliage and the amount of shade, renders the conditions

more favorable for the rapid development of the scale insects, since experience has shown that the scale flourishes best in dry, warm weather, and that wet weather and moist, heavily-shaded localities retard its development. The whale-oil soap may be used in accordance with directions previously given with a reasonable assurance that above 90 per cent of the scales on the tree will be killed by a thorough application. It seems certain that with careful usage pure kerosene may be applied with safety to trees of a certain age, with the possible exception of peach, but, as heretofore stated, each fruitgrower must experiment first in order to be certain that he knows how to apply the insecticide. The trees should be carefully watched after the treatment and on into the summer, and whenever crawling larvæ are found an application of kerosene emulsion or of the mechanical mixture of kerosene and water should be made in case the owner has not found the secret of safe application of pure kerosene. This application may have to be repeated later in the season.

A PRECAUTION IN DESTROYING RUINED TREES.

There is an important fact connected with the life history of the insect, to which particular attention must be called. On young trees the scales seem to extend not only to the surface of the ground, but even beneath the surface, so that in destroying a badly infested tree it is necessary not only to cut it off close to the ground, but to grub up the roots. Professor Webster tells me that a number of times in his experience where trees have been cut off below the surface of the ground, young shoots which sprung up afterwards were found to be covered with the scale, and Dr. Smith records a similar instance in his report for 1897. Professor Webster, in fact, records in "Entomological News" for December, 1897, an instance where a tree was cut off from 6 to 8 inches below the surface of the ground and scales were found on the young shoots which came up subsequently. He thinks that perhaps ants carry the young scale insects below ground.

OTHER REMEDIES.

As a matter of course, a certain amount of experimentation has been carried on by individuals with remedies other than those here mentioned and with mixtures already experimented with, as indicated in Bulletin No. 3. None of these, however, have shown sufficiently good results to necessitate detailed mention. The most successful experiment with a new substance which is known to the writer was tried by Mr. L. A. Snow, of Tifton, Ga., who sent to the office at the close of the year 1895 twigs of trees which he had sprayed with hot water. Examination showed that the scales were all killed except 6 larvæ on one twig, 2 females and 3 larvæ on another, and 1 female and 1 larva on a third. All of these living individuals, however, had been protected by buds or by scales.

LEGISLATION.

In Bulletin No. 3 we published a section on the subject of legislation and one on the nursery question. Since that time several States have adopted laws governing the traffic in nursery stock and also dealing with occurrences of the scale in nurseries and orchards, while interstate commerce in nursery stock is perhaps to be governed by the provisions of a national bill now before Congress. In a bulletin about to be published (No. 13, New Series) the writer has brought these laws together, and no general consideration of them is necessary at this time. The State of Illinois, while it has not passed an insect law, has made an appropriation to be expended by the State entomologist in actual field observations against the San Jose scale. Under this appropriation Professor Forbes has had nearly all of the Illinois nurseries inspected and certified by agents of his office, and is making an effort by means of parties of operators to exterminate the scales in the orchards at infested points referred to in a previous paragraph. He furnishes the owners of infested premises with apparatus and competent men to direct the work; but requires from owners that they will destroy stock hopelessly diseased, and will provide the necessary insecticides and the labor for the preparation and operation. The State of New Jersey, on the other hand, while it has also failed to enact laws, will not allow its entomologist to give certificates of inspection, and the entomologist himself is of the opinion that the scale has come to stay and that all work against it must be done by individual fruitgrowers themselves.

Although the reader is referred to the new compilation of the State laws, it may be well to state that strong objections have been urged to certain of the provisions of most of these laws. The insufficiency of inspection certificates has been insisted upon again and again. An interesting symposium on this subject was published in the Rural New Yorker of January 8, 1898. The entomologist of the New Jersey Station, to whom we have just referred, Dr. J. B. Smith, insisted upon the insufficiency of inspection certificates and called attention to their occasional misuse by nurserymen. Mr. Lowe, the entomologist of the experiment station at Geneva, N. Y., showed that it was practically impossible for one man to examine a nursery of average size so thoroughly that he could be sure he had not overlooked the scale. By systematic inspection carried on through a series of years, however, the entomologist can feel reasonably sure of bringing to light the worst cases of such injurious insects as San Jose scale. In this way the purchaser can feel that he is protected to a certain degree. Mr. Lowe could suggest no better protection for the purchaser than inspection, and, when recommended by the inspector, fumigation, and especially dealing with reliable firms. Mr. F. A. Waugh, of the Vermont Experiment Station, believed that entomologists' certificates were of less value than the guaranty of honest nurserymen. His closing words

were, "It will not do to depend too much on official investigation, however thorough." Professor Bailey, of Cornell University, stated it as his opinion that the certificate of a reputable entomologist, saying that he has examined the stock and has been unable to find San Jose scale, "is really worth a good deal to the purchaser. It does not guarantee the stock to be free by any means, but it establishes a very strong probability that it is free." In his opinion, however, an entomologist could not give a clean bill of health for all the trees of a nursery, for to make a sufficient examination to enable him to do so would cost more than the stock is worth. Mr. T. T. Lyon, a prominent horticulturist of Michigan, said that no certificates can be expected to amount to a guaranty against infestation. Nevertheless, he would consider a certified establishment more trustworthy, although the planter should carefully choose those in whose thorough carefulness and integrity he would have the greatest confidence. Mr. J. H. Hale, of Connecticut, was of the opinion that a careful examination by an entomologist would result in a certificate of some little value, but that the average nursery inspection affords "no guarantee whatever that the trees are free from San Jose scale." "Keep up the inspection," he said, "but do not place too much confidence in certificates." Mr. J. H. Bancroft, a Delaware inspector, said that certificates are not of much real value to a purchaser. In his opinion a planter should, so far as possible, grow his own stock. Professor Webster, of Ohio, has a strong article on this subject in "Entomological News" for December, 1897, and he illustrates the difficulties of inspection by showing pictures of a twig on which a single young scale occurred which was completely hidden by the bud so that it could not be seen without picking off the bud. He adduces, further, the fact that new shoots coming up from old stumps are frequently covered with scales, as indicating that the insects may occur below ground, and thus futilize inspection. He thinks that entomologists should not be compelled to risk their reputations where the odds are so much against them.

THE GERMAN EDICT.

By virtue of an edict promulgated by the German Government the first week in February, 1898, certain American fruits were refused entrance at the port of Hamburg, and the American newspapers of about that date were filled with rumors and interviews concerning the probable reasons of Germany's act. It soon appeared that the San Jose scale was the particular insect against which the edict was directed, and for the information of American fruit growers the exact wording of the decree, closely translated into English by Mr. E. A. Schwarz, is given herewith:

[No. 2443.]

Ordinance relating to the importation of living plants and fresh fruit from America.

[Dated February 5, 1898.]

We, Wilhelm, by God's Grace German Emperor, King of Prussia, etc., ordain, in the name of the Empire, with consent of the Federal Council, as follows:

1.

In order to guard against the importation of the San Jose Scale-louse (*Aspidiotus perniciosus*) the importation of living plants and parts of living plants [literally "fresh plant waste"] from America; and, further, of such barrels, boxes, and other objects, which were used for packing or transporting of such products or parts of products, is prohibited until further notice.

The same applies to invoices of fresh fruit or fresh parts of fruit from America, as well as to the packing material used thereto, whenever the examination which is to take place at the port of entry has ascertained the presence of the San Jose Scale-louse on the goods or on the packing material.

This prohibition, however, does not include goods and objects of the above kind which are brought in ships but which are not removed from the ship.

2.

The Imperial Chancellor is authorized to grant exceptions to this prohibition and to arrange the necessary measures of safety.

3.

The present ordinance goes into effect with the day of its publication.

Given under our own hand and Imperial Seal.

Berlin, February 5, 1898.

[L. S.] WILHELM.

(Countersigned:) COUNT VON POSADOWSKY.

Issued in the Imperial Department of the Interior.

Berlin, printed at the Imperial Printing Office. Published at Berlin, the 5th of February, 1898.

It appears from German sources of information that the immediate cause of the decree was the receipt of information by the Government, about the middle of January, that a large shipment of fruit from infested districts of North America would be sent to Hamburg. Directions were given for the immediate inspection of this cargo by expert authority upon its arrival. On the 29th January the San Jose scale was found in numbers in living and developing condition upon pears from California. This information was transmitted to the Government and the decree followed.

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In Bulletin No. 3 was published a chronological bibliography of the American writings on this insect, beginning with Comstock's original description in 1880 and extending down to the close of 1895. Several omissions have since been found in this list, and there follow a list of these omissions and a list of the writings published during 1896–97 and down to the date of this writing. These lists have been drawn up for the writer by Mr. Banks.

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